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Nanofibrillar cellulose hydrogel as a novel 3D scaffold for cell culturing

Liisa Kanninen

University of Helsinki, Finland

Abstract

The structure of hydrogels resembles extracellular matrix (ECM) *in vivo*. Thus, hydrogels are attractive scaffold materials for three-dimensional (3D) cell culturing. Various hydrogels, either synthetic or from natural origin, have been used as 3D cell culture scaffolds for different biomedical applications. From immunological point of view, hydrogel scaffolds without human or animal products are highly preferred. Here we show that plant-derived nanofibrillar cellulose (NFC) hydrogel promotes 3D culture of liver cells. NFC composes of fibrillar glucan chains whose diameter is in nanometer range and length in micrometer range. NFC hydrogel serves as a biocompatible culture scaffold without added growth factors. Human hepatic cell lines HepaRG and HepG2 form 3D multicellular spheroids in NFC hydrogel. Both cell lines secret human albumin confirming the liver-specific functionality of these cells. HepaRG cells polarize in 3D NFC hydrogel culture as revealed in filamentous actin (F-actin) immunostaining. Accumulation of F-actin in apical cell membrane domain demonstrates the formation of bile canalicular-like constructions. In conclusion, NFC hydrogel is a promising 3D scaffold for cell culturing. It provides ECM mimicking 3D environment, free of human and animal products, and it could be applied in organotypic culture systems for drug discovery and tissue engineering.

Biography

Liisa Kanninen, M.Sc. Pharmacy, is a Ph.D. student in the University of Helsinki, Faculty of Pharmacy, Division of Biopharmaceutics and Pharmacokinetics. She has published in the Journal of Controlled Release about 3D liver cell culturing. The aim of her research group is to create human liver models using 2D and 3D cell culturing.